



MS3
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GENERAL CERTIFICATE OF EDUCATION
TYSTYSGRIF ADDYSG GYFFREDINOL

MARKING SCHEMES

BIOLOGY
AS/Advanced

SUMMER 2008

INTRODUCTION

The marking schemes which follow were those used by WJEC for the Summer 2008 examination in GCE BIOLOGY. They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

AS MODULE BI1

Question	Answers/Explanatory Notes	Marks Available
1.	<p><i>Advantages</i></p> <p>Superior keeping qualities;</p> <p>Higher yield/larger flowers, plants or fruit;</p> <p>Pesticide/ herbicide resistance;</p> <p>Resistance to pests / disease;</p> <p>Enhanced nutritional value</p> <p>Specific example –frost/drought resistance (not: vague references to cost effectiveness/better quality plants/supermarket friendly)</p> <p><i>Disadvantages</i></p> <p>exchange of genetic material (by cross pollination);</p> <p>Reference to commercial manipulation of the market;</p> <p>Transfer of DNA with linked pathogenic genes e.g. oncogenes;</p> <p>Unknown effect of eating new protein/may contain harmful toxin;</p> <p>Spread of <u>pesticide</u> resistance;</p> <p>Increased use pesticides/chemical control (not: people's attitudes/mistrust/ref. reduction in variation)</p>	<p>[2 max]</p> <p>[2 max]</p>
2. (b)	<p>A Cell wall, protection/ turgidity/ stop cell bursting/ support/shape (not: strength/structure)</p> <p>B Chloroplast, photosynthesis</p> <p>C Plasmodesmata, movement of materials / symplastic or cytoplasmic flow/water movement (not: description e.g. cytoplasmic strands)</p> <p>D Vacuole, storage of materials / (cell) sap, keep cytoplasm pushed against cell wall/maintain turgor (not: contains water)</p>	<p>[1]</p> <p>[1]</p> <p>[1]</p> <p>[1]</p>

Question	Answers/Explanatory Notes	Marks Available
(b)	<p><u>Mitochondria</u>, provide energy / ATP (for activation of amino acids)</p> <p><u>Ribosomes</u>, translation of (mRNA) / join amino acids together/forms peptide bonds.</p> <p><u>Endoplasmic reticulum</u>, Ribosomes attached / proteins secreted into it / movement of protein / secondary structure / reference vesicles pinching off which move to golgi.</p> <p><u>Golgi</u>, assembly / packaging / quaternary structure / glycoproteins / membrane placed around them/ modification of protein.</p> <p><u>Cell membrane</u>, absorption of amino acids / secretion of protein/exocytosis.</p> <p><u>Nucleus</u>, mRNA / code for primary structure on DNA/DNA has genetic code.</p> <p><u>Nucleolus</u>, makes (tRNA and) rRNA / makes ribosomes.</p>	[1 mark each (7)]
(c)	<p>A = Ribosomes</p> <p>B = ER</p> <p>C = Golgi</p> <p>[1 mark per link]</p>	
(d)	<p>(i) Cellulose</p> <p>(ii) Starch accept amylose or amylopectin</p> <p>(iii) Ribose (not: pentose sugar)</p>	<p>[1]</p> <p>[1]</p> <p>[1]</p>

Question	Answers/Explanatory Notes	Marks Available
3. (a)	<p><i>Mitosis</i></p> <p>6 pairs / double structures; (not: if in pairs) In a line at the equator arranged singly; Plus any one of list below *</p> <p><i>Meiosis</i></p> <p>3 double structures/tetrads; In a line at the equator arranged in pairs; Plus any one of list below *</p> <p>* <i>either/both diagrams</i></p> <p>All attached to spindle fibres and labelled; Centromere labelled; Centriole labelled; Chromatids labelled Homologous chromosomes labelled</p>	<p>[3]</p> <p>[3]</p>
(b)	<p>$2^3 / 2 \times 2 \times 2;$</p> <p>$= 8;$</p>	<p>[1]</p> <p>[1]</p>
4. (a)	<p>(i) glycerol;</p> <p>3 fatty acids (labels required)</p> <p>(ii) ester</p> <p>(iii) phospholipid has phosphoric acid; phospholipid 2 fatty acids; phospholipid hydrophobic tails and hydrophilic head/polar molecule;</p>	<p>[max 2]</p> <p>[1]</p> <p>[max 2]</p>

Question	Answers/Explanatory Notes	Marks Available
(b)	fats have higher energy value (animal will not be as heavy if storing same energy values as carbohydrate.) (not: ref. other functions/more efficient)	[1]
(c)	saturated <u>more</u> hydrogen; Saturated solid at room temperature and unsaturated are liquid; unsaturated double bonds and saturated single/no double bonds; unsaturated kinky/bent tails and saturated straight.	[max 2]
(d)	(i) make contents of tubes alkaline/raise pH (not: ref. optimum pH) (ii) red (allow: green)	[1]
	(iii) lipase/enzyme hydrolyses/splits fats; fatty acids make contents acidic/lowering pH	[2]
	(iv) (heating has) changed shape of active sites; (not: destroy) denatured enzyme/ bonds broken; substrate no longer fits/complementary/ no enzyme-substrate complex forms. no fatty acids produced (not: ref. product/no digestion)	[2]
5.	<i>Graph A</i> Diffusion (allow: osmosis); As concentration difference increases rate of uptake increases; Not affected by respiratory inhibitors; No ATP required / passive. (not: energy) No consequential error if type of uptake incorrect.	[max 3, diffusion 1 mark + 2]

Question	Answers/Explanatory Notes	Marks Available
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Graph B

Facilitated diffusion;
 At higher concentration differences rate of uptake slows down / levels plateau;
 Transport/carrier/channel proteins / pores saturated / full/ number of pores is limiting factor;
 Not affected by respiratory inhibitors.
 No ATP required/passive
 (not: energy)

[max 3, facilitated diffusion 1 mark + 2]

Graph C

Active transport / active uptake;
 Rate slows down;
 Saturation of carriers / protein;
 Affected/slowed by respiratory inhibitors;
 Process needs ATP/it is an active process
 (not: energy)

[max 3, active transport 1 + 2]

6. (a) (i) Transfer/t RNA;
 Ribosomal/r RNA; [2]
- (ii) Comparative statements required.
 Similarity, double stranded [1]
 (allow: ref. to both are polynucleotides; not: nucleotide constituents)
- Differences;
 Ribose;
 Uracil not thymine;
 Smaller.
 Found in cytoplasm
 Not a double helix [max 3]

- (b) (i) 50% [1]
- (ii) 1 mark for each base + correct %

Nucleotide	%
<i>Adenine</i>	<i>10</i>
Thymine	10
Cytosine	40
Guanine	40

Full names and correct spelling required.

- 7.
- A. Protein + reference primary structure ie sequence amino acids
 - B. Reference secondary structure- description and explanation;
 - C. 3D folding;
 - D. Tertiary / globular;
 - E. Reference hydrogen bonding / ionic bonding /
hydrophobic interaction;
 - F. Reference disulphide bridges;
 - G. Active site as (specific) binding site for substrate;
 - H. Binding (with active site) lowers activation energy;
 - I. Collision theory eg ref. temperature and more successful collisions
 - J. Heat denaturation explained ie change shape of active site
 - K. Effects pH ie change of active site
 - L. Consequences of changes to active site ie substrate no longer fits (J
or K);
 - M. Reference to small change in pH reversible , high irreversible;
 - N. Reference competitive inhibitors binding to active site / co factors
 - O. Reference non competitive inhibition binding not at active site;
 - P. therefore changing shape of active site
 - Q. induced fit/ lock and key

Water

- A. Polar molecule / dipolar;
- B. Explanation of dipole, H +ve, O -ve;
- C. Hydrogen bonding explained;
- D. Importance surface tension eg walk on surface;

- E. Gases dissolve so available for aquatic organisms for respiration/photosynthesis;
- F. Universal solvent / dissolves polar and ionic substances or examples (not: many substances dissolve in water);
- G. Importance in transport of materials in blood or phloem/xylem;
- H. High latent heat of vaporisation;

- I. Explanation of importance, cooling body when sweating;

- J. High thermal capacity/specific heat;

- K. Explanation significance eg heats up slowly and cools down slowly;

- L. Importance of this in ability to maintain a constant temperature;

- M. Transparent so light passes through for photosynthesis;

- N. Ref. cohesion-tension theory and transpiration;

- O. Because less water mols per unit volume ice less dense and rises to surface/floats on top of water;
- P. Insulates preventing further heat loss eg hibernation in ponds/walking on surface;
- Q. Water a reactant eg in Photosynthesis/hydrolysis

AS MODULE BI2

Question	Answers/Explanatory Notes	Marks Available
1.	diffusion;	[1]
	osmosis;	[1]
	active transport;	[1]
		Total 3
2. (a)	<p><i>artery has:</i></p> <p>smaller lumen;</p> <p>more / thicker muscle/tunica media;</p> <p>more / thicker elastic/tunica externa;</p> <p>regular shape / AW;</p> <p><i>accept reverse for vein</i> (not: ref. size/cell wall/valves)</p>	[3 max]
(b) (i)	<p>blood tries to flow back;</p> <p>fills pocket</p> <p>forces valve to close (in correct context)</p>	[2 max]
(ii)	<p>no backflow;</p> <p>situated above heart;</p> <p>blood moves by gravity</p>	[1 max]
(iii)	<p>lie next to (skeletal) muscle;</p> <p>squeezes vein when muscle <u>contracts</u>;</p> <p>pushes / forces blood towards heart (not: suction effect of breathing)</p>	[2 max]

Question	Answers/Explanatory Notes	Marks Available
(c) (i)	<p>possess haemoglobin/no nucleus so more haemoglobin carried; (not: respiratory pigment) forms oxyhaemoglobin / combines with or high affinity for oxygen;</p> <p>rbc have a large surface area;</p> <p>increased by <u>b</u>iconcave shape;</p> <p>flexible / elastic membrane;</p> <p>allows greater contact with capillary walls/can squeeze through capillaries</p>	[3 max]
(ii)	<p>carry carbon dioxide/buffer hydrogen ions; (not: remove)</p>	
3. (a) (i)	<p>A = alveoli;</p> <p>B = bronchiole (not: bronchi)</p>	[2]
(ii)	<p>emphysema;</p> <p>(walls of) alveoli broken down (not: damaged);</p> <p>alveoli (merged to) form large space/reduced number of alveoli;</p> <p>walls of alveoli thicker (not: lose elasticity/reduced surface area for gas exchange)</p>	[1] [2 max]
(iii)	<p>smaller (overall) area for gaseous exchange;</p> <p>less oxygen absorbed;</p> <p>by diffusion/longer diffusion pathway;</p> <p>loss of elasticity reduces recoil/lungs remain inflated in correct context</p>	[2 max]

Question	Answers/Explanatory Notes	Marks Available
(b) (i)	arrow on any capillary in gill plate showing blood flow in opposite direction to water;	[1]
(ii)	H indicated on right hand side, on gill plate; L indicated on left hand side, on gill plate;	[2]
(iii)	counter current; (not: counter flow) maintain (oxygen/concentration) gradient/equilibrium not reached; along whole length of capillaries/filament; exchange occurs over a longer period;	[1] [1 max]
		Total 12
4. (a) (i)	as diameter increases rate of transpiration increases; correct reference to figures to show increase; rate levels off / plateau / no increase as diameter increases; reference to figures to describe plateau;	[3 max]
(ii)	wind blows away water <u>vapour</u> ; reference to boundary layer/shell; increases / maintains water potential or diffusion gradient; between leaves / air spaces in leaves and surrounding air;	[3]

Question	Answers/Explanatory Notes	Marks Available										
(b) (i)	A = sieve tube / element / cell (not: ref. sieve plate); B = companion cell;	[2]										
(ii)	translocation; of sucrose/amino acids; (not: sugars/glucose/products photosynthesis) from source to sink/named examples; in solution/of soluble substances; ref. to mass flow / cytoplasmic streaming;	[3 max]										
(iii)	<table><tr><th>Cell A</th><th>Cell B</th></tr><tr><td>x</td><td>✓</td></tr><tr><td>x</td><td>x</td></tr><tr><td>✓</td><td>✓</td></tr><tr><td>✓</td><td>✓</td></tr></table>	Cell A	Cell B	x	✓	x	x	✓	✓	✓	✓	[4]
Cell A	Cell B											
x	✓											
x	x											
✓	✓											
✓	✓											
		Total 11										
5. (a) (i)	fossil fuels;	[1]										
(ii)	A = photosynthesis; B = respiration;	[2]										

Question	Answers/Explanatory Notes	Marks Available
(b) (i)	(increased) combustion of fossil fuels; more energy required; burning releases carbon dioxide; deforestation (ie large scale removal); less photosynthesis to absorb carbon dioxide;	[3 max]
(ii)	global warming / greenhouse effect; (not: ref. acid rain/ozone layer) relevant effect of above; ref. rate of photosynthesis	[2]
(iii)	reduce use of fossil fuels; alternative energy sources / named example; carbon tax; insulation of buildings; greater use of public transport; develop cycle routes / safe walking routes; reduce deforestation (ie large scale); afforestation; (not: ref. recycling/green cars/rely less on vehicles)	[3 max]
		Total 15

Question	Answers/Explanatory Notes	Marks Available
6. (a)	respiration; movement; heat loss; death; excretion/waste products; egestion/defaecation; non consumed/inedible material;	[3 max]
(b) (i)	28.6/28.57 (kg day^{-1}) (not: 29); 0.8 (kg day^{-1}) 8.8/8.79	[3]
(ii)	cow has greater efficiency of conversion/ results in greatest total mass / sheep give wool as well / rabbits because of greater daily mass increase; [1] (not: rabbits consume food more quickly)	[1]
		Total 7

Question	Answers/Explanatory Notes	Marks Available
7. (a) (i)	<p>A improve/increase crop yield/ growth;</p> <p>B increase nitrogen/nitrate / phosphate / potassium content of the soil;</p> <p>C used to make amino acids;</p> <p>D turned into proteins / nucleic acids;</p>	[3 max]
(ii)	<p>E leached into watercourses / lakes / rivers;</p> <p>F causes algal bloom / <u>excess</u> algal growth (not: plants);</p> <p>G blocks out sunlight to water plants;</p> <p>H plants die (not: algae);</p> <p>I decay by bacteria/decomposers;</p> <p>J bacteria aerobic/use up oxygen/ref. BOD;</p> <p>K rapid/increased growth of bacteria;</p> <p>L oxygen depletion of water;</p> <p>M death of fish / aquatic life (not: ref. suffocation);</p> <p>N eutrophication;</p>	[7 max]
		Total 10

7. (b) (i) A death/decline phase- greater numbers dying than being produced;
- B lag phase where little increase in numbers;
- C exponential / log phase – rapid increase in numbers;
- D stationary phase, numbers produced equals numbers dying/maximum carrying capacity reached;
- E accumulation/increase toxic waste;
- F emigration exceeds immigration;
- G disease (epidemic);
- H increase in predators/parasites;
- I food shortages;
- J climate change/adverse weather conditions/natural disaster qualified;
- K increased competition;
- L insufficient living space;
- M reference to human interventions eg deforestation;
- N reference to density dependent and independent factors;

[3 max]

[7 max]

Total 10

AS MODULE BI4

Question	Answers/Explanatory Notes	Marks Available
1. ATP		
(a)	<p>A Phosphate(s)</p> <p>B Adenine</p> <p>C Ribose</p>	[3]
(b)	Nucleotides	[1]
(c)	<p>It is the major energy currency of the cell;</p> <p>(provides energy) for cellular activities of the cell / protein synthesis / active transport / muscle contraction;</p> <p>used for synthesising RNA / DNA</p> <p>(not: used for respiration/source of energy unqual)</p>	[Any 2]
(d)	<p>Cytoplasm</p> <p>Mitochondria/specified region</p> <p>Chloroplasts</p> <p>Mesosome</p>	[3]
		Total 9 marks

Question	Answers/Explanatory Notes	Marks Available
2.		
(a)	<i>Plasmodium</i> (any species) (not: abbreviation)	[1]
(b)	Will not be attacked by antibodies	[1]
(c)	Act as an antigen; Be recognised as foreign / non-self	[1]
(d)	Vaccinations (become / are not effective)	[1]
(e)	More chance of a mosquito drinking infected blood; More likely to be passed to vector / mosquito; More likely to be spread by vector to another human. (not: ref. to host)	[1]
		Total 5 marks

3.(a)

<i>Factor</i>	<i>Control</i>
pH	Addition of acid / alkali/base
Temperature	Use of cooling jacket
Oxygen levels	Addition of air/oxygen through spargers / eg

(not: use buffer/insulate/control contamination or nutrients)

[3]

- (b) Arrow at top of Log phase on curve [1]
- because product / bacteria can be harvested in minimum time;
no build up of toxins / does not run out of methanol or nutrients;
bacteria do not start dying. [1]

Question	Answers/Explanatory Notes	Marks Available
(c)	More efficient due to high yield Very rapid rate of growth; Grown continuously on a large scale; Can be carried out at physiological / lower temps / press; Can use waste products (not: yield unequal/ref. to cost)	[3]
(d)	To minimise the lag phase /allow bacteria to adapt to conditions/reduce contamination.	[1]
(e)	Penicillin / mycoprotein / beer / wine / quorn/vinegar	[1]
Total 10 marks		
4. (a)	viruses use host ribosomes to synthesise protein, therefore no effect/viruses do not contain ribosomes	[1]
(b)	Tetracycline, all bacterial cells synthesise proteins	[1]
(c)	Penicillin / vancomycin, protective layer of lipopolysaccharide (not: more complex cell wall)	[1]
(d)	tetracycline, cells die if they cannot synthesise proteins/ cells can carry out metabolic processes without cell wall development.	[1]
(e)	(random) mutations; (selective) advantage / selection pressure favours the resistant bacteria / survival of resistant bacteria; reproduction / cloning to give resistant population.	[3]
(f)	via plasmids (during conjugation) (not: ref. vector)	[1]
(g)	MRSA / TB / <i>E. coli</i> / <i>C. difficile</i> / VRE/VRSA (not: Staphylococcus/Streptococcus)	[1]
Total 9 marks		

Question	Answers/Explanatory Notes	Marks Available
5.		
(a)	A carbon dioxide B coenzyme A / Acetylcoenzyme A / Acetyl CoA C Oxygen D Water	[4]
(b)	Box in correct place to include glucose and pyruvate	[1]
(c)	Mitochondrial matrix	[1]
	Cristae / <u>inner</u> mitochondrial membrane of mitochondrion	[1]
(d)	E clearly between glucose and TP ATP between TP and pyruvate between 5 and 4 acids	[1] [1 for both]
(e)	dehydrogenase;	[1]
(f)	reduced NAD / eq; (used to) reduce pyruvate; to lactate; (not: lactate+ATP or energy) NAD regenerated	 [any 2]
(g)	glycerol enters at TP Fatty acids enter at B	[1] [1]

Total 14 marks

Question	Answers/Explanatory Notes	Marks Available
6.		
(a)	Thymus	[1]
(b)	Cancer / malignancy / viral diseases (not: named disease)	[1]
(c)		

<i>Name of Cell type</i>	<i>Function</i>
Cytotoxic / Killer (T cells)	Destruction / lysis of (virus) infected cells. (not: kill)
Helper (T cells)	Stimulate Ab production by B lymphocytes
Memory (T cells)	Divide rapidly if Ag is encountered again / secondary immune response
Suppressor (T cells)	Slow down the immune response, when Ag has been destroyed/infection over

[Any 3 **matched pairs**]

[6 marks]

Total 8 marks

Question	Answers/Explanatory Notes	Marks Available
7.		
(a)	<p>Photosynthesis produces oxygen (as a by-product);</p> <p>Aerobic bacteria are attracted to the oxygen; (not: bacteria need oxygen unequal)</p> <p>Most bacteria [are in / move to] the [blue and red regions / stated wavelengths] of the spectrum / few bacteria in the green region;</p> <p>Most photosynthesis is in the blue / red region;</p>	[3 max]
(b)	action spectrum	[1]
(c)	<p>light <u>absorbed</u> by photosystems / chlorophyll a;</p> <p>they emit/give off electrons;</p> <p>electrons from PSII/P680 pass to PSI/P700 via series of carriers; (not: passed along electron transport chain)</p> <p>ATP synthesis;</p> <p>Electrons from PSI pass to NADP;</p> <p>Mention of <u>photolysis</u> of <u>water</u>;</p> <p>Electrons from photolysis replace those lost from PSII</p> <p>Formation of oxygen in context</p>	[4 max]
(d)	<p>Oxygen used in respiration / diffuses out of leaf; (not: given off)</p> <p>ATP supplies energy and phosphate in <u>Calvin cycle/eq.</u>;</p> <p>NADPH₂ / NADPH + H enter [<u>Calvin Cycle</u> / eq] / used to reduce CO₂ / to synthesise glucose.</p>	[Any 2]
		Total 10 marks

8. (a)
- A Correct name of technique used **SERIAL DILUTION**;
 - B Any valid sterilising techniques for equipment eg autoclave;
 - C Any valid aseptic technique eg flaming bottle neck;
(not: flaming loop)
 - D 9 cm³ (sterile) deionised / distilled water placed in series of bacteriology / test tubes with lids (correct 9:1 ratio)
 - E 1 cm³ bacterial sample placed in first tube (and mixed);
 - F 1 cm³ of this transferred to next tube and mixed and repeat for remaining tubes;
 - G Transfer of 0.1 / 0.5 / 1.0 cm³ of each sample onto a (sterile) nutrient agar plate; (not: loop and streak plate)
 - H only lifting lid slightly to prevent contamination;
 - I Repeat this twice to give a total of 3 plates per dilution;
 - J Use of (sterile) spreader to spread sample around plate
 - K Seal plates with tape plus explanation;
 - L Incubate at 25°C for 24 hours;
 - M Selection of suitable plates (60-100 / countable colonies) and count colonies
 - N Explanation of working out means of 3 plates and **correct** calculation (multiplication to get number of bacteria per cm³ of original bacteria sample)
 - O Explanation of inaccuracies with clumping/viable cell gives visible colony

[Marks may be taken from appropriately annotated diagrams]

[Total 10 marks max]

8. (b)
- A Absorption occurs in ileum/ good capillary supply;
 - B Surface area increased by villi and microvilli;
 - C Glucose/monosaccharides absorbed by facilitated diffusion / active transport;
 - D Any mention of sodium dependent glucose transporters;

 - E Glucose diffuses down the concentration gradient (facilitated diffusion) into the **capillary/ blood** in the villus;
 - F Amino acids taken up by (active transport);

 - G Blood travels from the gut to the liver via the hepatic portal vein;

 - H Fatty acids and glycerol / monoglycerides (enter the epithelium) by diffusion across the plasma membrane;
 - I Micelles fuse with/bump into the brush border and the lipids / monoglycerides /fatty acids / glycerol are absorbed;

 - J Lipids move into lacteal/secretion of lipid containing vesicles / chylomicrons into **lacteal**;

 - K Through lymphatic system rejoining bloodstream at thoracic duct/ into subclavian vein;

 - L Glucose used for respiration / stored as glycogen / lipid ;

 - M Amino acids used for protein synthesis;

 - N Excess deaminated and amino groups converted to urea / remainder enters respiration;

 - O Lipids used for membranes / hormones /stored as fat

[Marks may be taken from appropriately annotated diagrams]

[Total 10 marks max]

AS MODULE BI5

Question	Answers/Explanatory Notes	Marks Available
1. (a) (i)	Order	
(ii)	Family	
(iii)	Genus	
(iv)	Species	
	[4 correct = 2 marks 3 correct = 1 mark]	[2]
(b) (i)	(Two names first name =)genus	[1]
	(Second name =) species	[1]
(ii)	<i>Panthera tigris</i> (not: <i>P. tigris</i>)	[1]
(iii)	<i>Equus zebra</i> and <i>Gorilla gorilla</i> both for (not: <i>E. zebra</i> / <i>G. gorilla</i> ? <i>zebra/gorilla</i>)	[1]
(c) (i)	Genetic/DNA/RNA fingerprinting / (gel) electrophoresis (not: DNA profiling)	[1]
(ii)	They split/cut the DNA/RNA into fragments (not: ref plasmids) At specific points/ sequences/bases/ into a number of fragments of specific size	[1]
(iii)	<i>Equus asinus</i> and <i>Equus zebra</i>	[1]
(iv)	They belong to the same genus/differ only by species	[1]
	And will therefore share <u>more common</u> /similar DNA	[1]
		Total 12

Question	Answers/Explanatory Notes	Marks Available										
2. (a)(i)	Any suitable letters, allele for black and no markings in capitals, 4 single letters	[1]										
(ii)	Black with wing markings X grey with no markings Correct genotypes and phenotypes	[1]										
(iii)	Correct gametes, AND correct representation of fertilisation)	[1]										
(iv)	Correct genotypes (all heterozygous for both characteristics	[1]										
(b)(i)	Correct genotypes – both heterozygous for both characteristics Correct gametes e.g. B, G + B, g + b, G + b, g Punnet square, correctly labelled Correctly completed	[1] [1] [1] [1]										
	<table><tr><td>Phenotype</td><td>Number of Offspring</td></tr><tr><td>Black(wings) no markings/tips</td><td>54</td></tr><tr><td>Black (wings) with markings/tips</td><td>18</td></tr><tr><td>Grey (wings) no markings/tips</td><td>18</td></tr><tr><td>Grey (wings) with markings/tips</td><td>6</td></tr></table>	Phenotype	Number of Offspring	Black(wings) no markings/tips	54	Black (wings) with markings/tips	18	Grey (wings) no markings/tips	18	Grey (wings) with markings/tips	6	
Phenotype	Number of Offspring											
Black(wings) no markings/tips	54											
Black (wings) with markings/tips	18											
Grey (wings) no markings/tips	18											
Grey (wings) with markings/tips	6											
	Correct phenotypes	[1]										
	Correct numbers	[1]										

Question	Answers/Explanatory Notes	Marks Available
(c) (i)	(All) the alleles (of all the genes) in a population/ species (not: genes)	[1]
(ii)	mutation / immigration / emigration	[1]
(iii)	(Pollution blackens trees) Black moths have survival advantage/ survive to reproduce/predated less	[1]
	(Natural selection) increases black allele in gene pool/pass on favourable allele/gene	[1]
	In unpolluted area grey allele/gene will be selected	[1]
(iv)	new species formed / speciation	[1]
		Total 16
3. (a) (i)	A – (proximal convoluted) tubule, B – glomerulus, C – Bowman’s capsule (not: renal capsule) [3 correct = 2 marks, 2 correct = 1 mark]	[2]
(ii)	cortex	[1]
(iii)	Arrow point to outer edge of glomerulus	[1]
(iv)	Microvilli/brush border to increase surface area (Basal) channels / folding of basement membrane to increase surface area (Numerous) mitochondria to provide energy for <u>active transport</u> [2 max]	[1] [1] [2 max]
(b) (i)	Protein and glucose	Both for [1]
(ii)	$(179/180 \times 100 =)$ 99.4% (not: 99.5/99)	[1]
(iii)	$(25/53 \times 100 =)$ 47.2 /47.17/47.169 % (not: 47.16/47)	[1]

Question	Answers/Explanatory Notes	Marks Available
(c) (i)	D-Loop of Henle E-collecting duct	Both for [1]
(ii)	Ascending limb pump (Na) ions out/ by active transport	[1]
	Descending limb absorb (Na) ions in by diffusion	[1]
(iii)	Osmosis (not: osmoregulation)	[1]
(iv)	Antidiuretic hormone / ADH	[1]
(v)	X - Kangaroo rat, Y –Domestic cat, Z – Beaver.	All 3 for [1]
(vi)	The drier the habitat the longer the loop of Henle (not: ref. heat)	[1]
		Total 16

Question	Answers/Explanatory Notes	Marks Available
4. (a)		
A	Biodiversity is the variety/number of species on earth/ecosystem/habitat/area	[1]
B	Extinction is the loss of <u>species</u>	[1]
C	Conservation is the planned preservation of wildlife/gene pool/maintenance of biosphere and enhancement of biodiversity	[1]
D	Agriculture has reduced biodiversity by;	[1]
E	Destroying habitats;	[1]
F	E.g. Removing hedges (or other suitable example);	[1]
G	Using pesticides / herbicides/chemicals in context;	[1]
H	Introducing alien agricultural species to compete with wildlife / correct reference to monoculture;	[1]
I	Urbanisation / building roads / houses / factories /draining wetlands / deforestation/pollution qual, also destroys habitats;	[1]
J	Over-hunting / over-fishing / other unsustainable harvesting;	[1]
K	Conservation steps include, seed / sperm banks;	[1]
L	Captive breeding programmes / rare breeds societies / reintroduction programmes e.g. Red Kite;	[1]
M	Trade restrictions on endangered species / reference to CITES	[1]
N	Relevant reference to NGOs e.g. WWFN / government agency e,g, NCC/SSSI/National Parks/Ecotourism	[1]
O	Correct reference to relevant legislation e.g. to prevent over-grazing / over-fishing / hunting /poaching in context/ collecting birds eggs / picking wild flowers / collecting plants;	[1]
[Max 10 marks from available 15]		Total 10

4. (b)
- A Suitable/optimum temperature related to enzyme activity [1]
(not: warmth)
 - B Water for mobilisation of enzymes / vacuolation of cells /
Transport/starch hydrolysis [1]
 - C Oxygen is needed for respiration / provide energy for growth /
to produce ATP; [1]
 - D Food reserves are insoluble (and cannot be transported); [1]
 - E They must be broken down into soluble substances so that
they can be moved/ dissolved in water/ absorbed; [1]
 - F Initially water is taken up rapidly by seed / reference to imbibition
/ through micropyle; [1]
 - G Tissues swell; [1]
 - H Enzymes are mobilised / reconstituted / rehydrated; [1]
 - I Enzymes hydrolyse / digest food stores / [1]
 - J Example such as amylase and starch. Producing maltose; [1]
 - K Maltose / sugars / soluble products are transported to growing
points [1]
 - L Testa / seed coat ruptures [1]
 - M Radicle grows downwards and/ or plumule grows upwards [1]
 - N Germination begins after a period of dormancy [1]
 - O Hormones are involved in breaking dormancy/ref. gibberellins [1]

[Max 10 marks from available 15]

[Marks for (a) or (b) only to be awarded]

Total 10

Question	Answers/Explanatory Notes	Marks Available
5. (a)(i)	Correct drawing showing phospholipids bilayer, heads out tails in plus embedded proteins, gap between tails	[1]
	<u>Phospholipids</u> correctly labelled.	[1]
	Proteins correctly labelled. (Drawing with no labels: 1 max)	[1]
(ii)	Proteins	[1]
(iii)	Exocytosis / Active transport / facilitated diffusion	[1]
(b) (i)	Acetyl choline	[1]
(ii)	Cholinesterase (not: cholinase)	[1]
(iii)	To prevent merging of impulses / muscle spasm/continuous firing of action potential or transmission	[1]
(c)	Inhibitor binds to enzyme molecule at a site other than the active site/allosteric site;	[1]
	Its binding alters the (3D) shape of the enzyme molecule distorting the Shape/structure of the active site / preventing access to / blocking active site;	[1]
	Substrate is unable to bind to active site/fit into enzyme/not able to form enzyme-substrate complex (not: inactivated)	[1]
(ii)	Muscles contract uncontrollably / spasm/tetany (not: ref. firing impulses/paralysis)	[1]
		Total 12

Question	Answers/Explanatory Notes	Marks Available
6. (a) (i)	Q – pollen (grain)	[1]
	R – sperm(atozoon) (not: spermatid/spermatocyte)	[1]
(ii)	Transfer nucleus / DNA / genetic material (to ovum)/fertilisation	[1]
(iii)	Q terrestrial R aquatic	[1]
(iv)	Q / sculptured (exine) to catch wind or attach to insects /stick to stigma/ waterproof (exine) to prevent dehydration	[1]
	R tail for swimming	[1]
(b)	Internal fertilisation / developing a penis / intromittent organ / seminal fluid/(body) fluid/solution	[1]
(c) (i)	meiosis	[1]
(ii)	Chromosomes drawn as two chromatids (joined by centromere)	[1]
	Homologous chromosomes correctly paired (2 similar alongside each other)	[1]
	Chromosomes either side of, and equidistant from equator	[1]
(iii)	increase variation	[1]
	Any one from: halving/ shuffling chromosomes/crossing over	[1]

Total 13

Question	Answers/Explanatory Notes	Marks Available
7. (a)(i)	nucleus/nucleoplasm (not: nucleolus)	[1]
(ii)	DNA	[1]
(iii)	<u>Messenger</u> RNA / <u>m</u> RNA	[1]
(b)(i)	Ribosome	[1]
(ii)	Transfer RNA / tRNA	[1]
(iii)	Protein/polypeptides (not: amino acids)	[1]
(c)	The mRNA/tRNA accumulates at the tip / no mRNA/tRNA found in central portion / ribosomes only at tip / no ribosomes found in central portion/RER.	[1]
(d)	Nucleus removed from (fertilised) egg/zygote of donor mother (not: embryo)	[1]
	Nucleus removed from cell of animal to be cloned and transferred to (enucleated) egg cell	[1]
	Hybrid cell grown in culture / Petri dish to multi cell embryo	[1]
	(Embryo) implanted/transferred into (womb of) surrogate mother	[1]
		Total 11



WJEC
245 Western Avenue
Cardiff CF5 2YX
Tel No 029 2026 5000
Fax 029 2057 5994
E-mail: exams@wjec.co.uk
website: www.wjec.co.uk/exams.html